

Domestic Nuclear Detection Office (DNDO)

Characterizing Risk in the Global Supply Chain

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System: Measuring Performance and
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GSC Risk Perspective

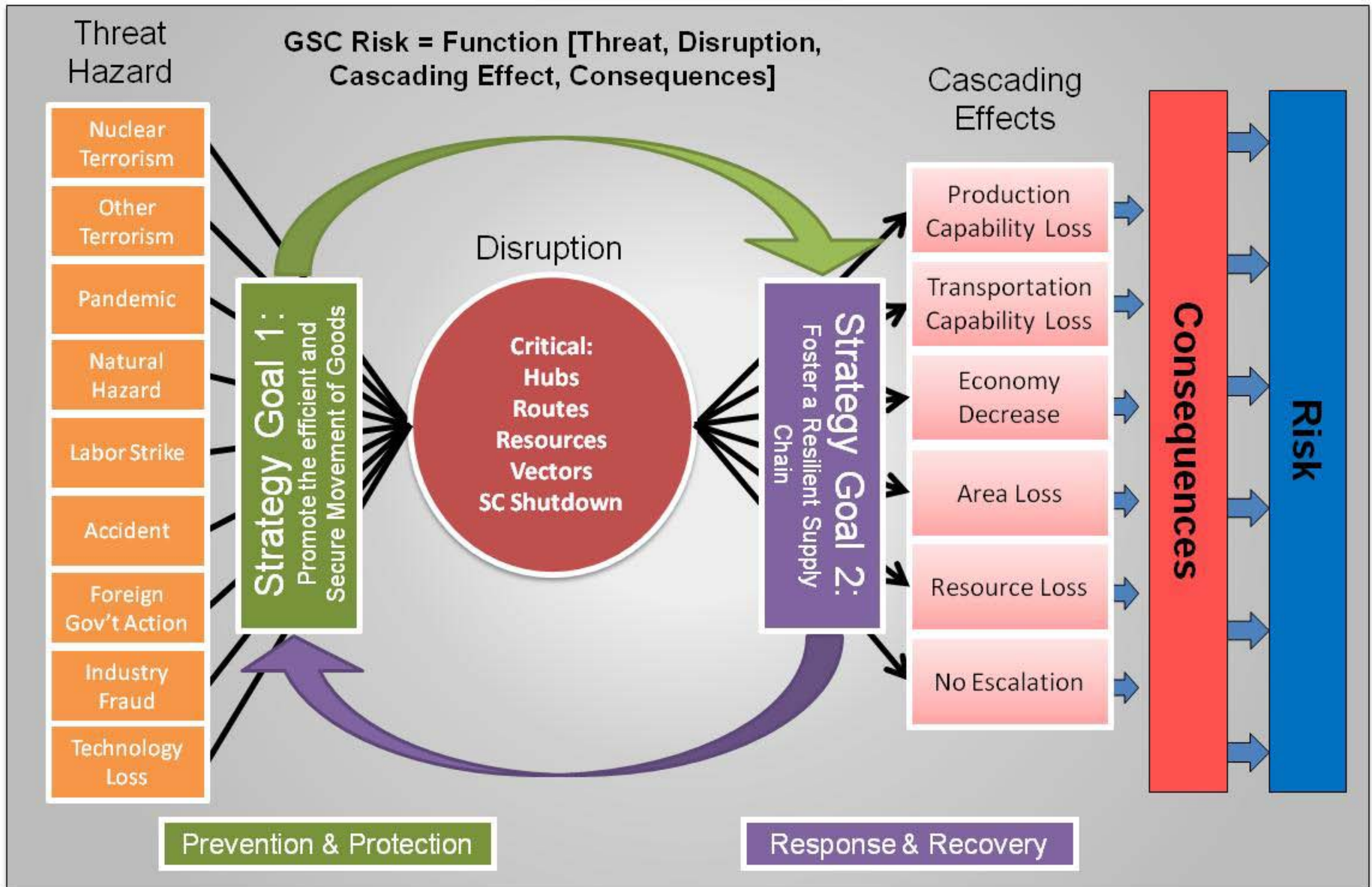
- **Previous work includes many studies on risk, vulnerability, and security of individual supply chains**
 - Considerable effort spent on managing supply chains, supply chain resiliency, supply chain vulnerability
 - Vast majority of work performed by industry and/or insurance
 - Numerous case studies of supply chain failures and successes
- **Global Supply Chain concept is less well defined**
 - Aggregation of supply chains?
 - National level or even global effects?
- **Key trends and features that drive risks**
 - ***Cascading Effects*** (small disruptions that escalate to major or catastrophic consequences)
 - Greater global interconnectedness
 - Greater reliance on 'just-in-time' supply chains

Principal Focus of the GSC Risk Assessment Effort is to Evaluate GSC Risk While Incorporating Cascading Effects



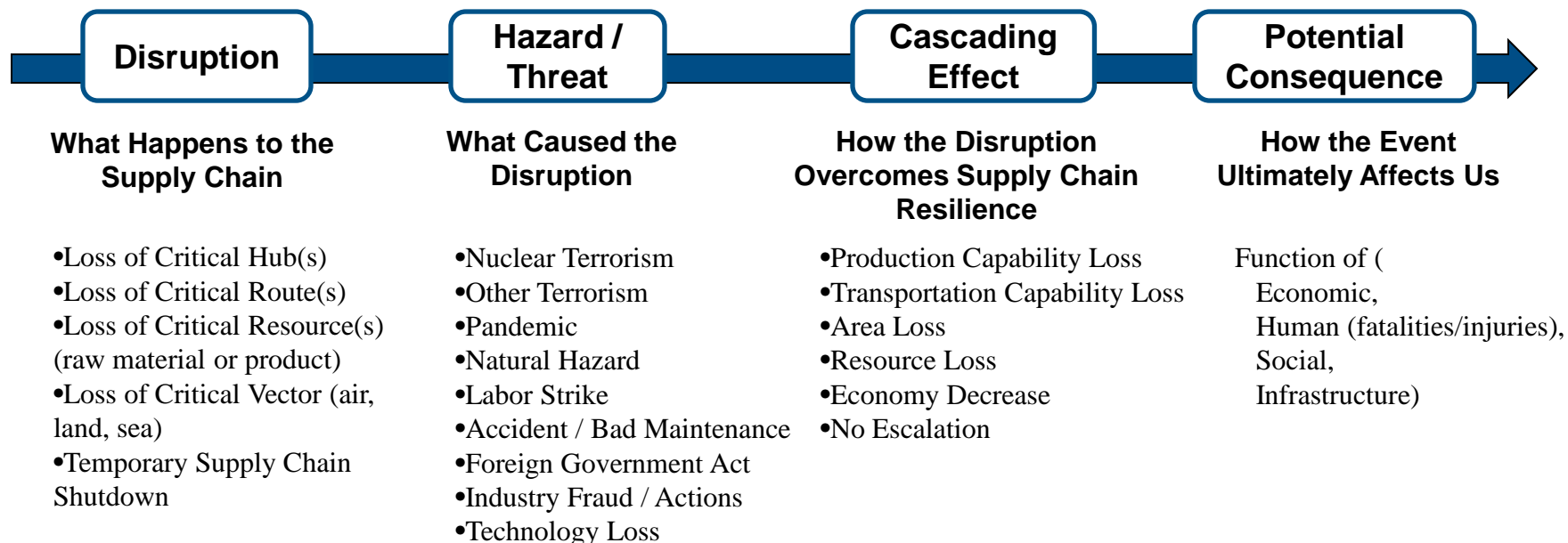
GSC Risk Characterization

GSC Risk = Function [Threat, Disruption, Cascading Effect, Consequences]



Scenario Structure Overview

Scenario Components



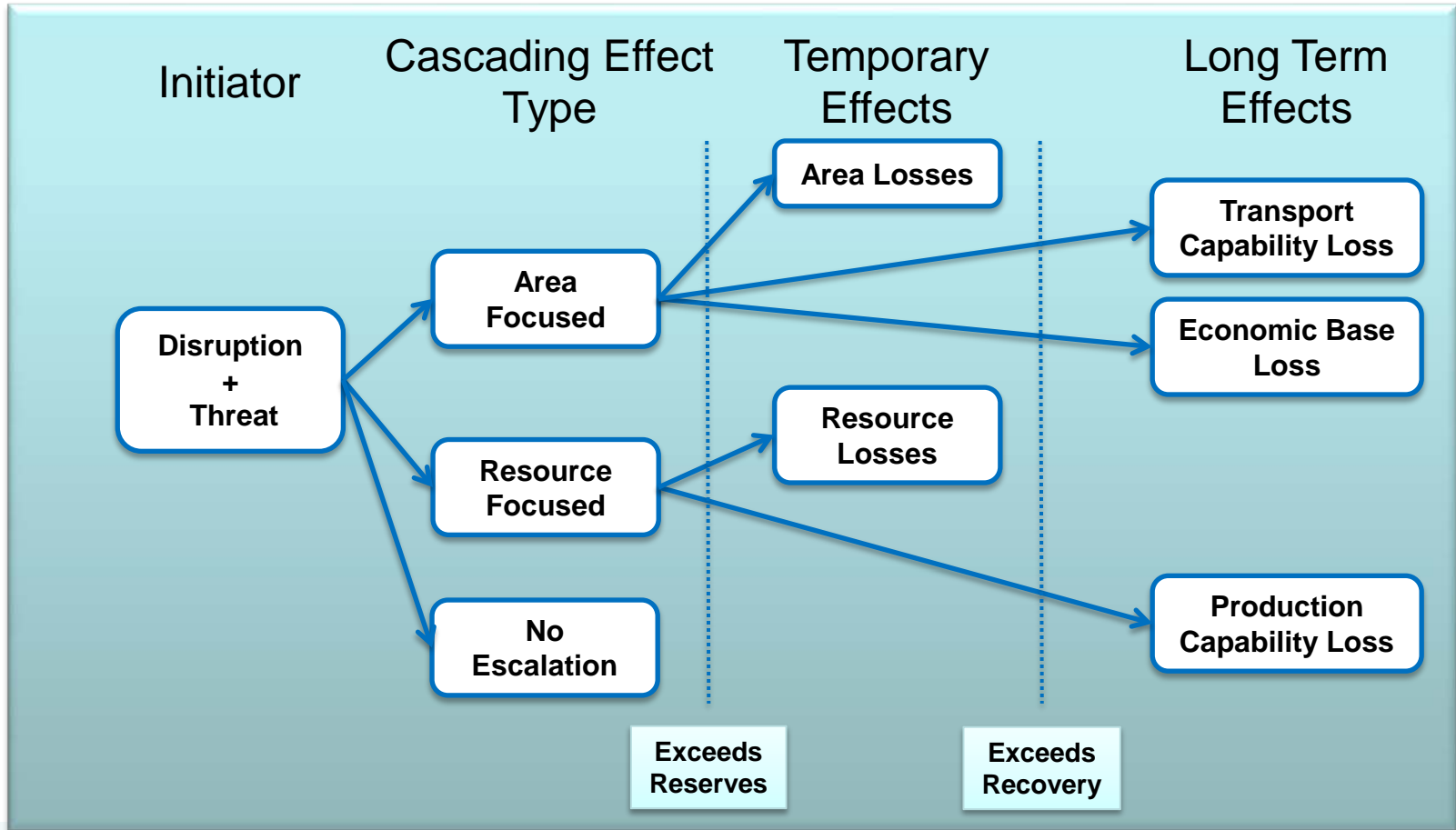
- **Individual scenarios are combinations of the first three components (consequences are a dependent result of the first three components)**
 - Results in 270 potential scenarios
 - General Morphological Analysis applied for consistency reduces number to ~133
- **Methodology evaluates likelihood and consequences for each scenario to obtain overall risk**



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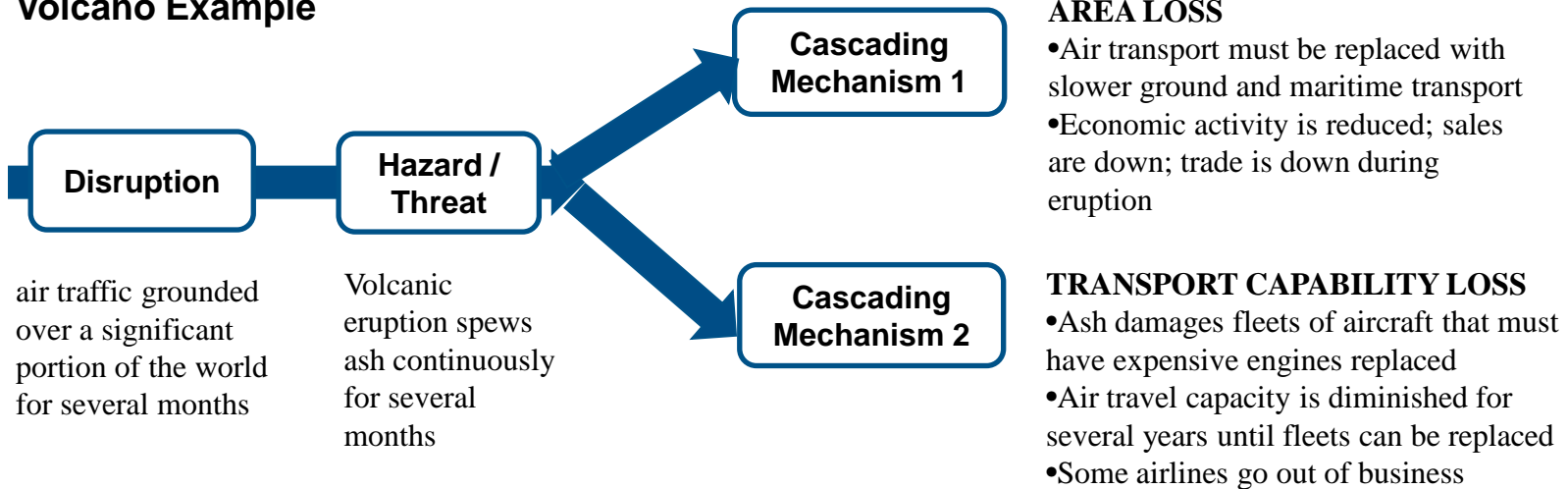
Cascading Effect Taxonomy

- Cascading Effects may be focused on a geographical area or a critical resource
- The duration of a disruption is a key factor in whether the effects are temporary or permanent



Cascading Effect Example Showing Area Loss and Transport Loss

Volcano Example



Evaluating Escalation Mechanism Likelihood

➤ Attributes Below Will Be Combined into a Score Using a Multi-Attribute Utility Function and Transformed into Relative Likelihood Estimates

<u>Size</u> (# Supply Chains Impacted)	<u>Duration</u> (from warning to recovery)	<u>Uniqueness</u> (% of impacted supply chains covered by alternatives)	<u>Criticality</u> (importance to manufacturing or vital product)	<u>Connectedness</u> (# 1 st order connections to/from affected component)
Very Many	No Recovery	No Alternatives	Irreplaceable	Thousands
Many	Recovery Beyond Reserves	Most Have Alternatives	Difficult to replace	Hundreds
Some	Recovery Within Reserves	All Have Alternatives	Replacements exist	Tens
Few	Rapid Recovery	Common	Easily replaced	Few



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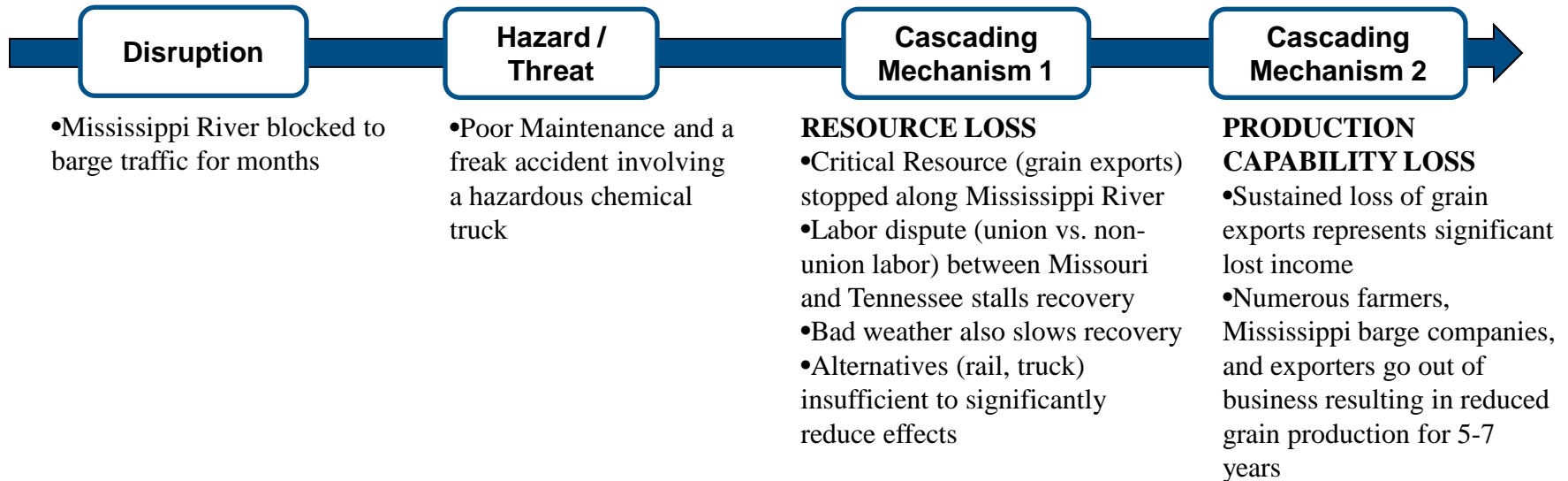
ADDITIONAL EXAMPLES



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Cascading Effect Example of Resource Loss and Production Loss

Memphis Bridge Accident Example



Cascading Effect Example Showing No Escalation and Economic Base Loss

Nuclear Explosion at Major U.S. Seaport

